

Argumentation

Reading Group 27 March 2009
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What is an argument?

- 'reasoning' sense:
 - a reason or reasons why you support or oppose an idea or suggestion, or the process of explaining them
 - a coherent series of statements leading from a premise to a conclusion
- 'dialogue' sense:
 - discourse intended to persuade
 - a disagreement, or the process of disagreeing
 - debate, discussion

Bench-Capon & Dunne
Artificial Intelligence 171, 619-641, 2007

ARGUMENTATION IN ARTIFICIAL INTELLIGENCE

Overview

- Foundations of argumentation in AI
 - non-classical logics
 - dialogue processes
 - diagrammatic argument structure
- Recent trends in argumentation

Foundations: logic

- non-monotonic logics
 - can deal with incomplete and uncertain information
 - e.g. default reasoning, logic programming
 - argumentation to support reasoning and explanation
- Dung's abstract argumentation framework (AF)
 - arguments, defeat relation (assumed given)
 - extension-based semantics for acceptability of arguments
 - start of argumentation as independent research area
- link: assumption-based frameworks (ABF)

Foundations: dialogue

- philosophical analysis of fallacy
 - classification of types of fallacy (rhetorics)
 - nature of possible attacking arguments (Walton's critical questions)
- computational ideas
 - commitment store, dialogue rules, locutions
- taxonomy of dialogue types (Walton & Krabbe)
 - e.g. persuasion, negotiation, inquiry, deliberation, information seeking
- dialectical proof theory: analysing argument justifiability

Foundations: argument structure

- argumentation templates/schemes
- diagrammatic models
 - Toulmin: Claim, Data, Warrant, Backing, Rebuttal conditions
- argument visualisation
- argument construction
- argument interchange
 - Argument Interchange Format (AIF)

Recent trends in argumentation (1)

- formal theory
 - extension-based semantics
 - algorithms & complexity
 - dialectical proof theory
- multi-agent systems
 - negotiation, reasoning in an uncertain world
- practical reasoning
 - actions, goals, desires, planning, values

Recent trends in argumentation (2)

- argument diagrams (informal logic)
 - Araucaria, Compendium, AIF
- specialist domains and applications
 - law, medicine
- miscellaneous
 - deductive argument frameworks, probabilistic argumentation/possibilistic logic, natural language, game theory

Rahwan, Ramchurn, Jennings, McBurney, Parsons & Sonenberg
The Knowledge Engineering Review 18:4, 343-375, 2004

ARGUMENTATION-BASED NEGOTIATION

Overview

- Approaches to automated negotiation
- External elements of ABN frameworks
- Elements of ABN agents

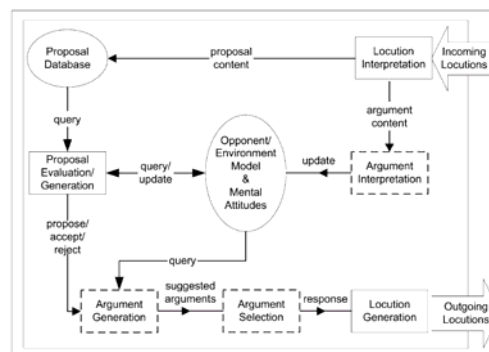
Approaches to automated negotiation

- game-theoretic
 - rationality, equilibrium, optimal strategy
 - outcome space known, utilities/preferences completely characterised and fixed, no additional info
- heuristic-based
 - suboptimal outcomes, difficult to predict behaviour, no additional info
- argumentation-based
 - justify negotiation stance
 - influence other's negotiation stance
 - critique on offers can make negotiation more efficient

External elements of ABN frameworks

- communication language
 - locutions/utterances/speech acts
 - e.g. KQML, FIPA ACL
- domain language
 - attributes, values, plans, resources, mental attitudes (BDI)
- negotiation protocol
 - interaction protocol, rules of dialogue
- information stores
 - utterance history, commitment store

Elements of ABN agents



Elements of ABN agents

- argument/proposal evaluation
 - objective considerations: correctness of inference steps, validity of assumptions
 - subjective considerations: preferences, motivations, utilities, trust
- argument/proposal generation
 - candidate arguments to accompany proposals, e.g. threats, rewards
- argument selection
 - strategy to select best argument in circumstances

Remarks

- current approaches to argumentation-based negotiation focus on
 - the bidding phase
 - autonomous agents
- no work done yet on argumentation-based
 - preference modelling
 - negotiation support and explanation
- argumentation in general provides interesting leads for the Pocket Negotiator